

Hangman Creek TMDL

- **Phosphorus** – a quick review of sources and processes
- **WARMF model** – a quick overview
- **Scenario results**
- **Where do we go from here?**



Phosphorus Sources

- ✓ Soils and underlying geology
- ✓ Air particulates – burning, hydrocarbon exhaust, windborne dust
- ✓ Decaying vegetation and organic materials
- ✓ Municipal Wastewater treatment plants
- ✓ On-site (septic) systems



Phosphorus Sources (continued)

- ✓ Industrial and commercial processes
- ✓ Stormwater run-off
- ✓ Fertilizers
- ✓ Manure



Phosphorus Transport

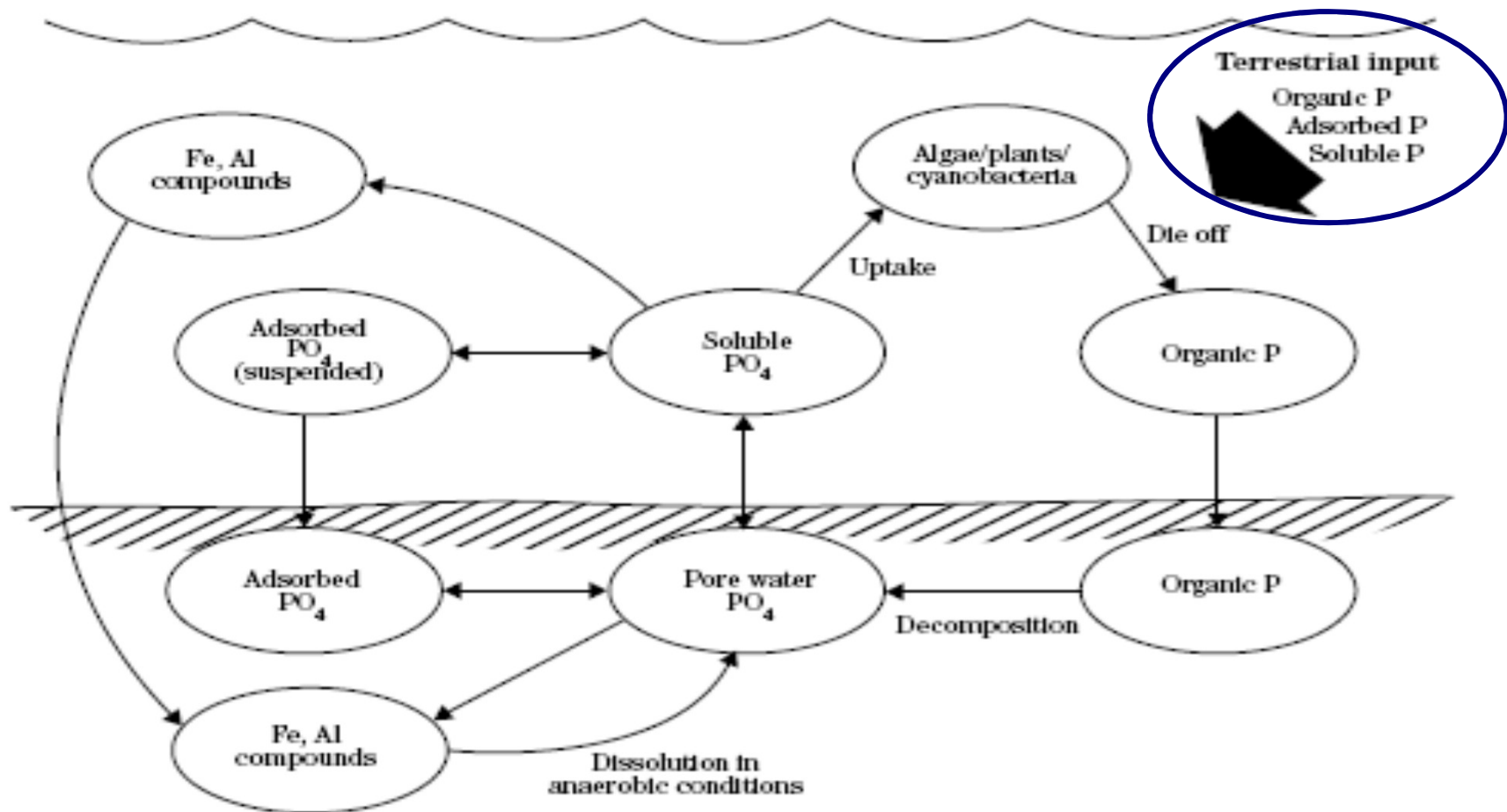
- ✓ Soil erosion – water and wind
- ✓ Stormwater run-off
- ✓ Streambank and bed erosion
- ✓ Fallout – dry and rainfall
- ✓ Point source collection and discharge systems
- ✓ Groundwater



Aquatic Phosphorus Cycle

Appendix A

Phosphorus cycle in aquatic ecosystems



WARMF Model

- WARMF = Watershed Analysis and Risk Management Framework
- Multiple sub-watershed loads individually run and linked by a stream course network.
- Stream channel erosion and other water quality features simulated in the stream course network.
- Daily time-step loads calculated



WARMF Model Structure

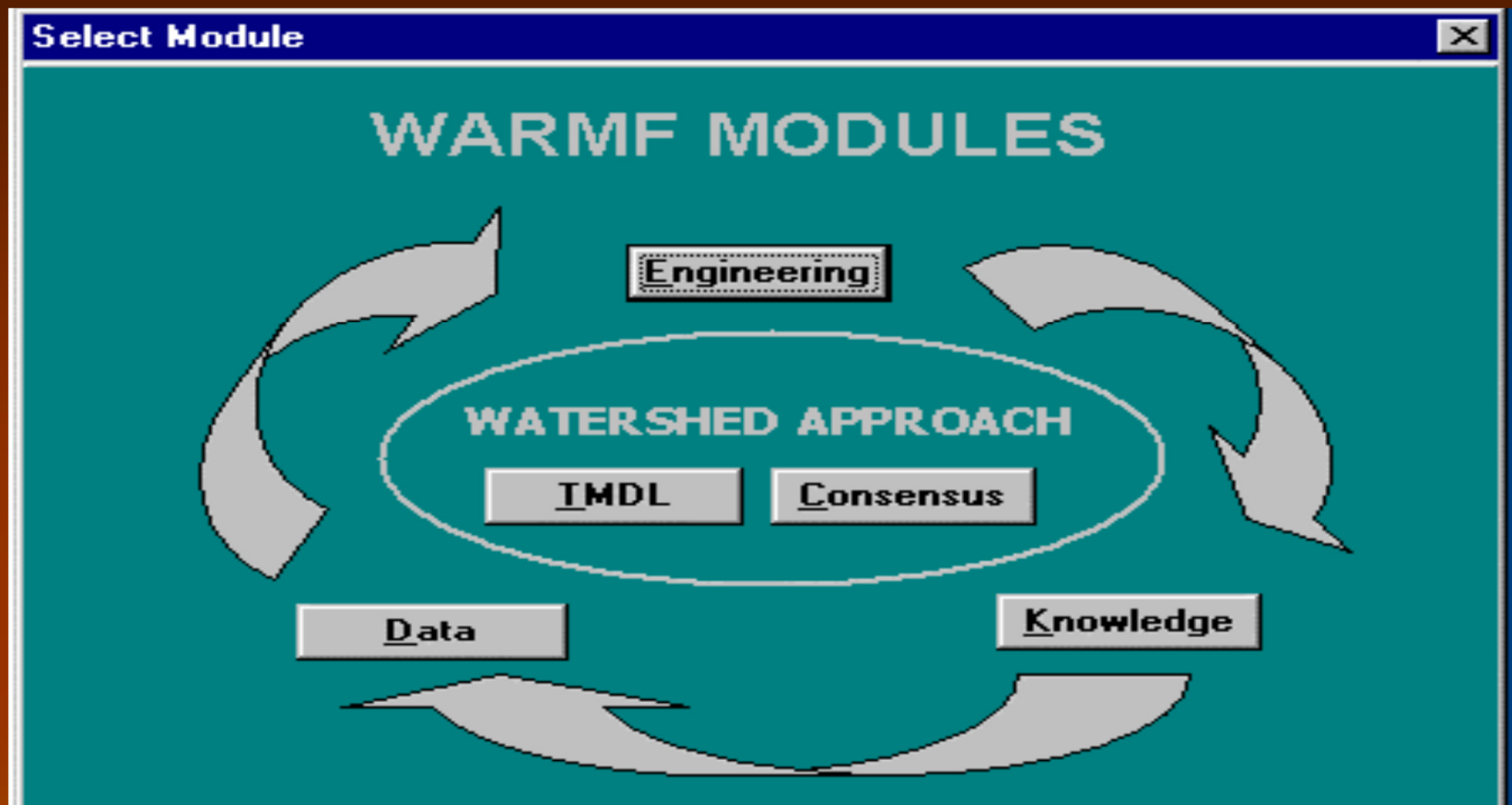
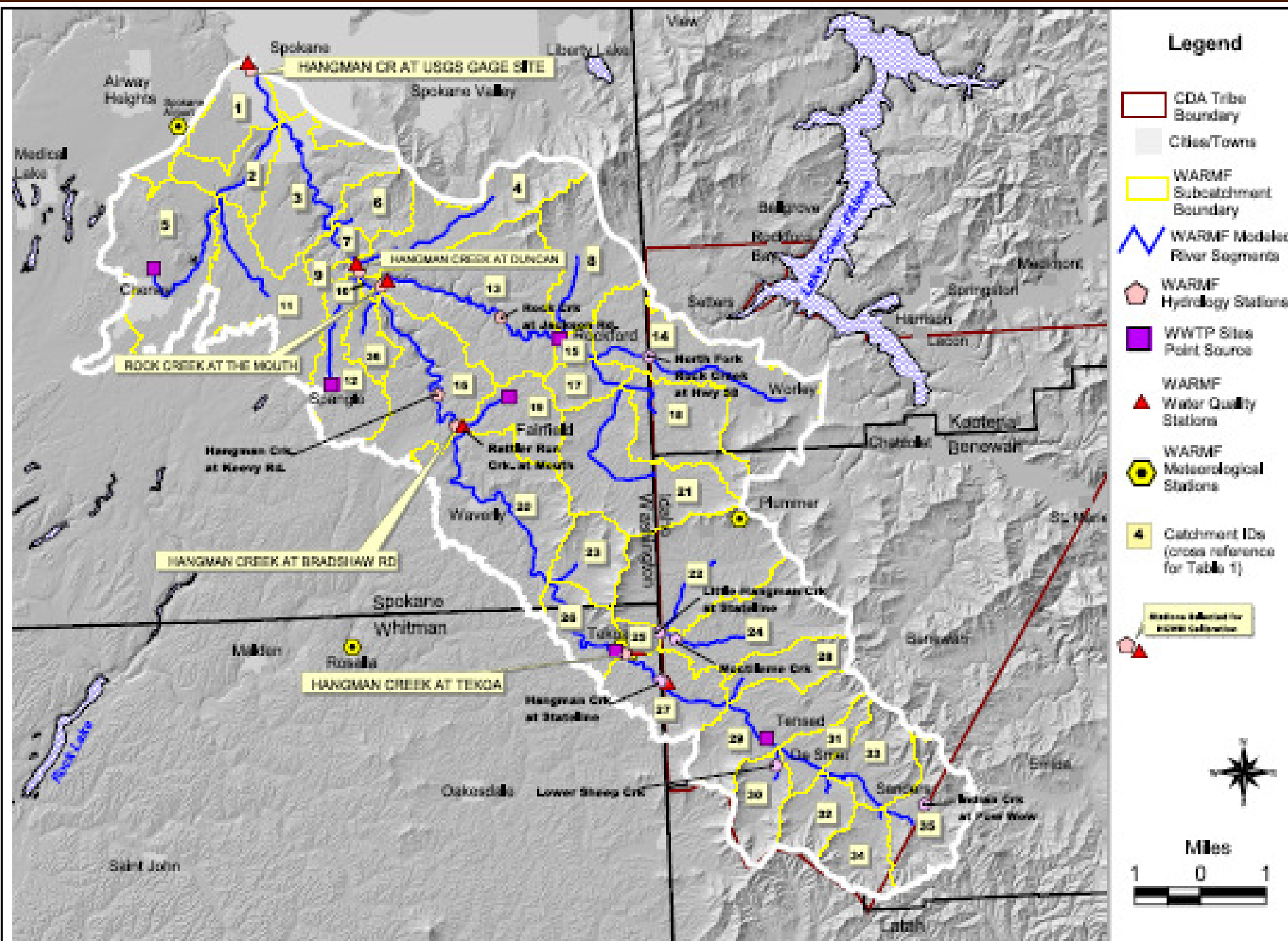
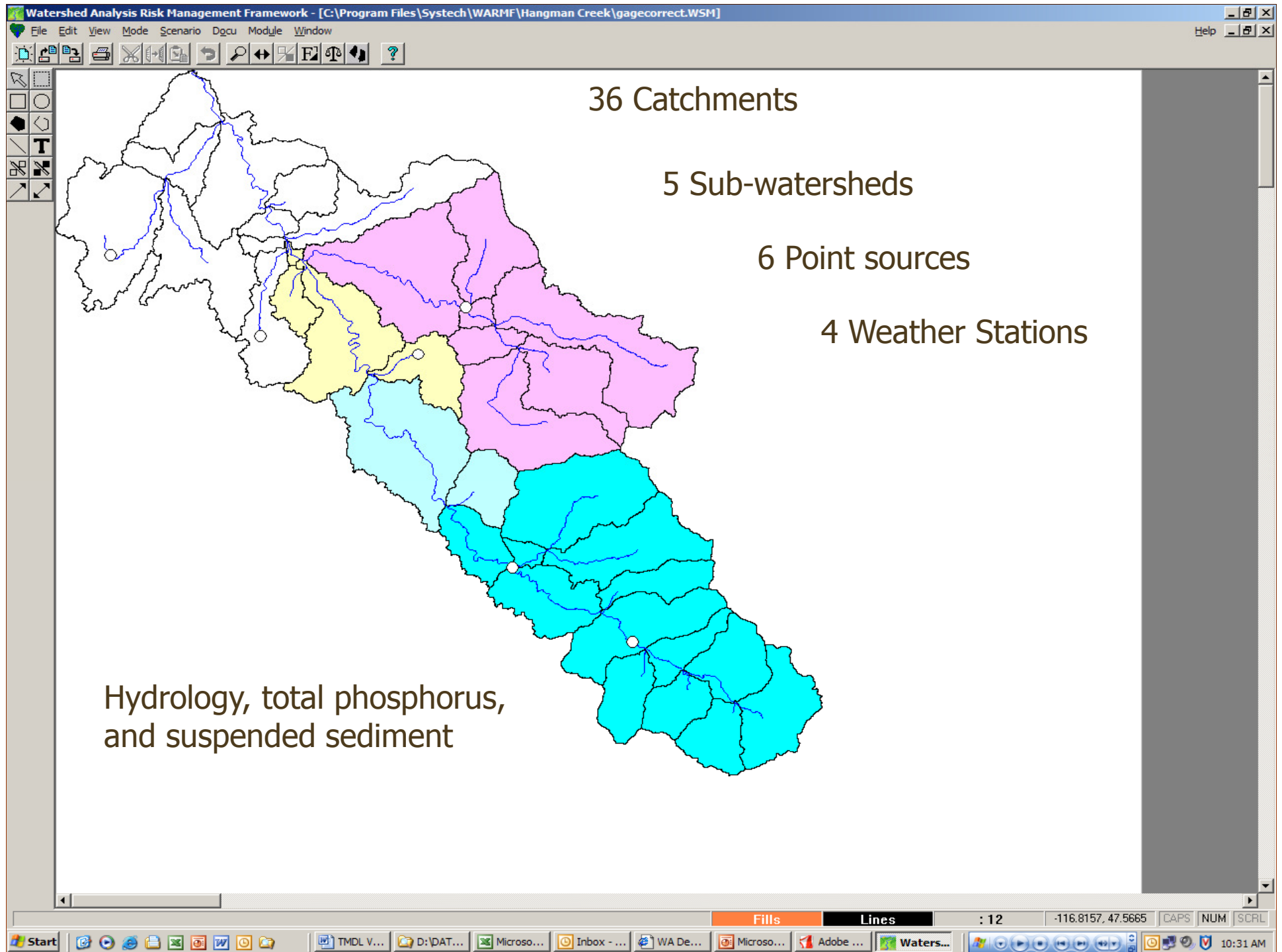


Figure 2.1
The Five Modules of WARMF.





Hangman WARMF Version 'Managed' Mechanisms

- **Soil**

- estimates of physical characteristics
- estimates of chemical characteristics
- mechanisms for erosion and transport to waterways
- mechanisms for groundwater transport

- **Hydrology**

- stream network and channel characterization
- climate, landform, soil, and land use effects on water balance
- point source additions – constant & intermittent



Hangman WARMF Version 'Missing' Mechanisms

- **Biology**

- accurate estimates of crop litter, harvest, and fertilizer applications
- crop rotations and soil fertility
- periphyton & algae biomass rates and functions

- **Wastewater**

- stormwater network characterization
- septic system populations and system failure rates
- more point source data
- proven method to simulate a wetland system



Hangman WARMF Version 'Missing' Mechanisms

- **Air**
 - estimates of dry and precipitation phosphorus fallout by region
 - variability from grass burning years
- **Wastewater**
 - stormwater network characterization
 - septic system populations and system failure rates
 - more point source data
 - proven method to simulate a wetland system

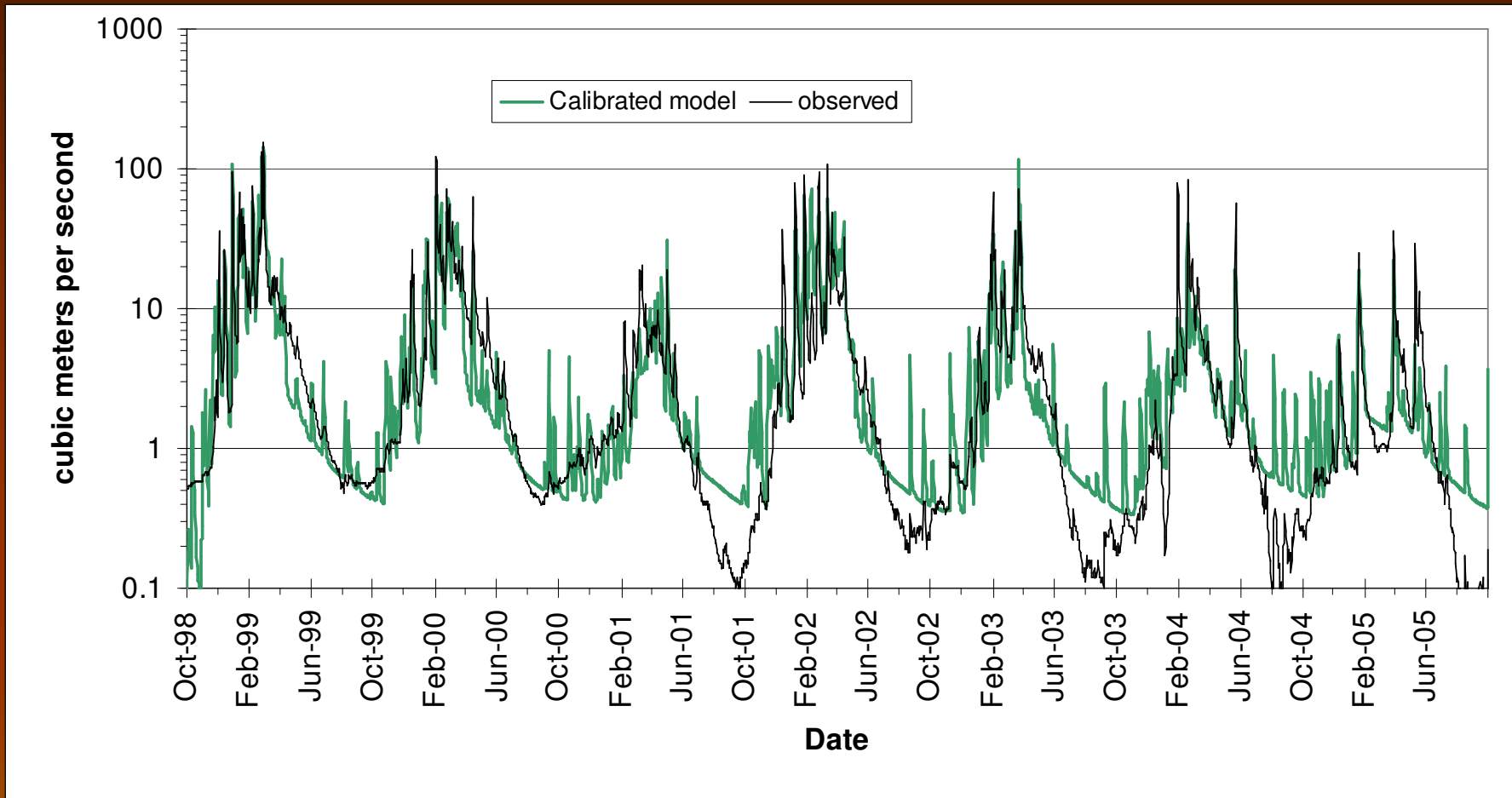


Model Calibration Corrections

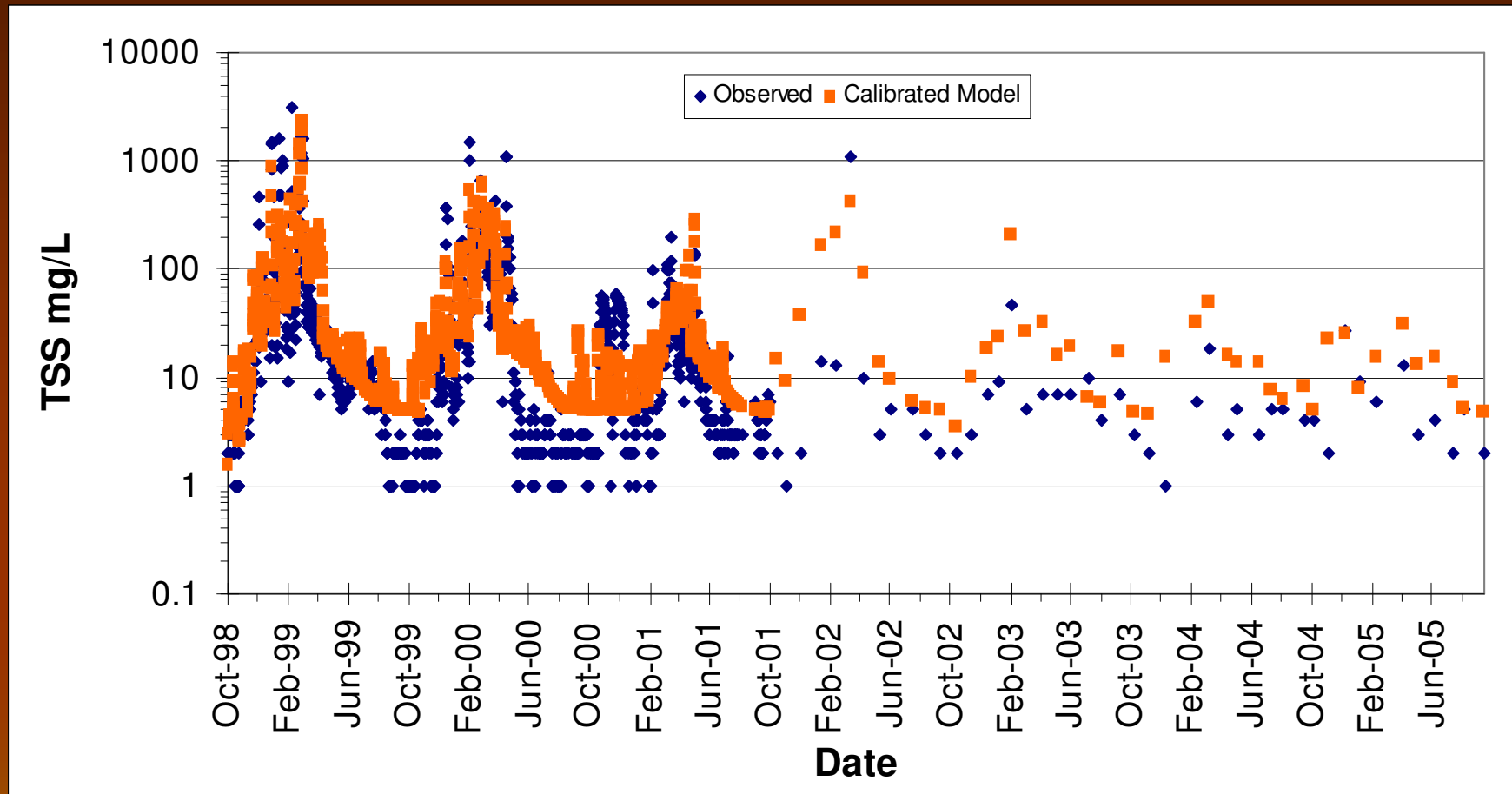
- Improved stream hydrology based on SCCD gaging data
- Corrected point source operation input
 - Cheney wetland
 - Rockford and Fairfield intermittent discharges
- Improved septic system use estimates
- Took streambank erosion estimates across the border



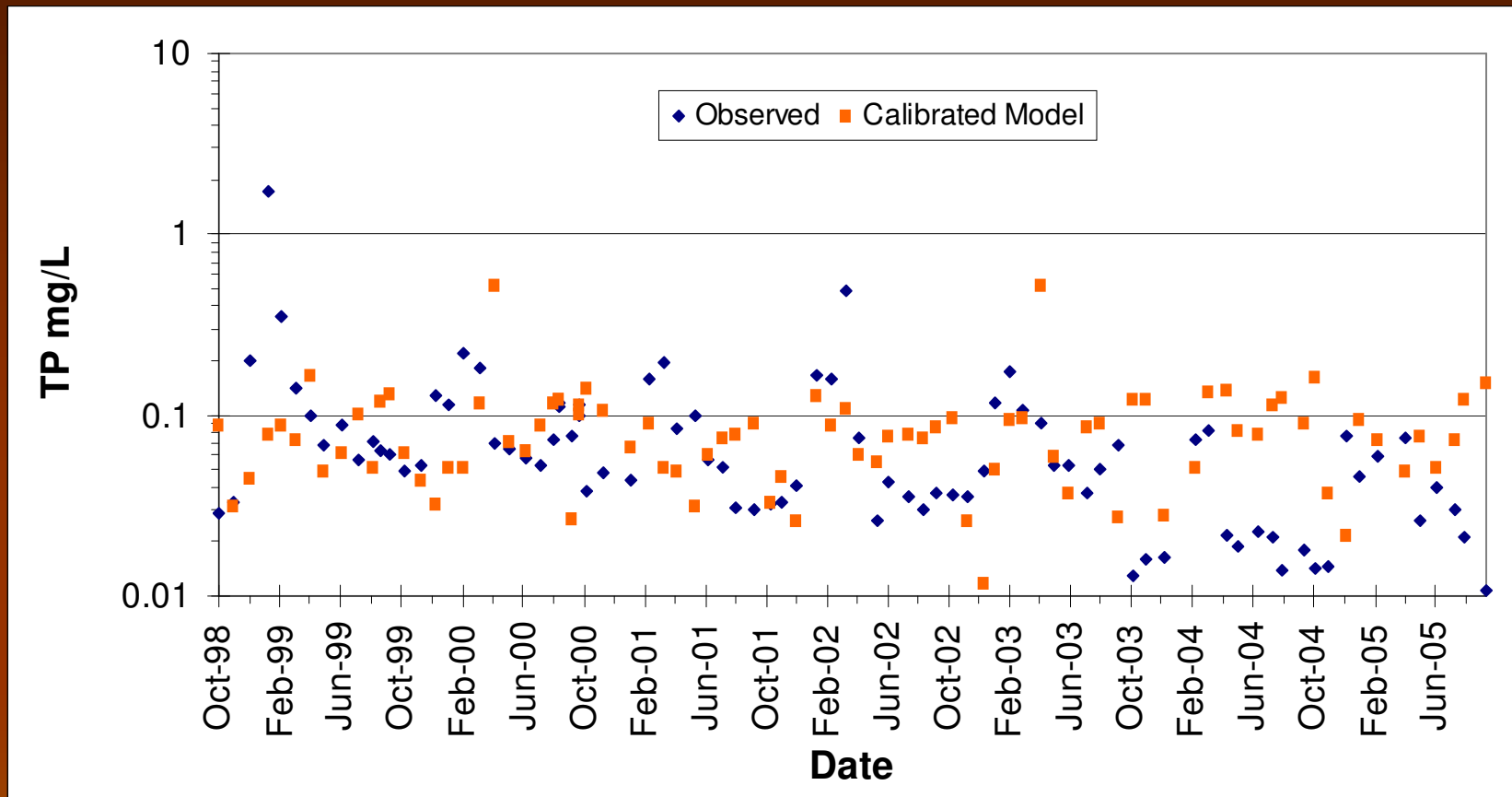
Hangman Creek Model Calibration



Hangman Creek Model Calibration



Hangman Creek Model Calibration



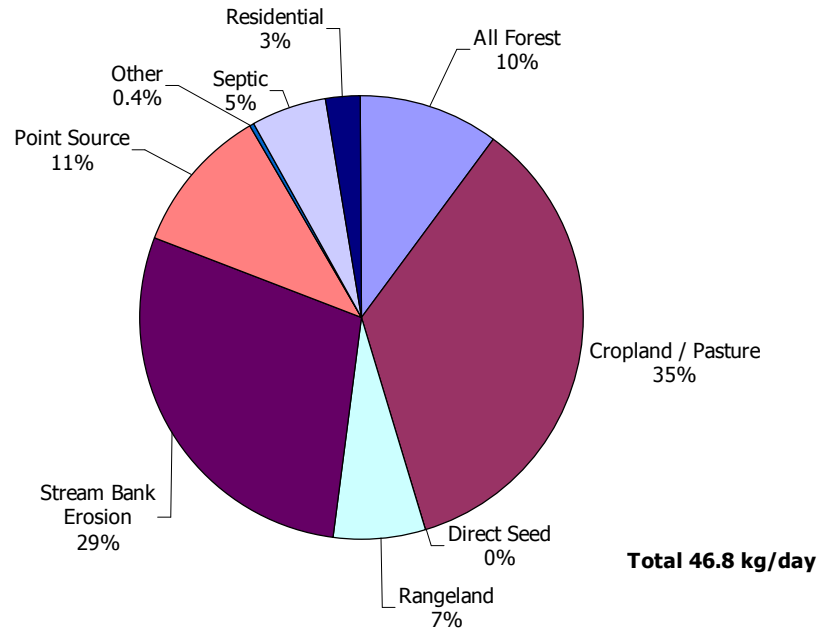
Requested Scenarios

- **Reference condition (best future)**
 - No point sources
 - 10' riparian buffers
 - Increased forest cover above Rockford and Tensed
 - Limited residential growth in lower watershed
 - 60% of agriculture in direct seed type

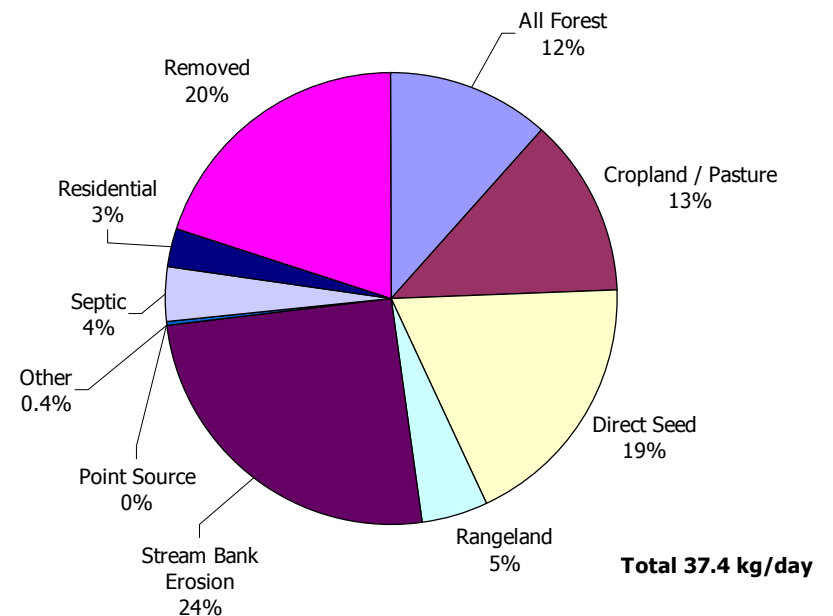


Comparison: Base to Reference

**Current Conditions
Total P at Mouth**



**Reference Conditions
Total P at Mouth**

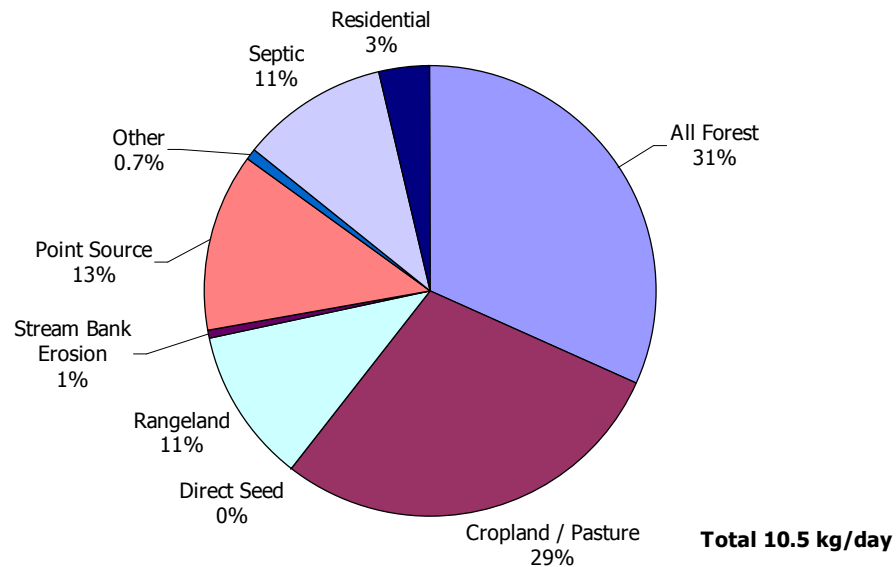


Hangman Creek at the Mouth

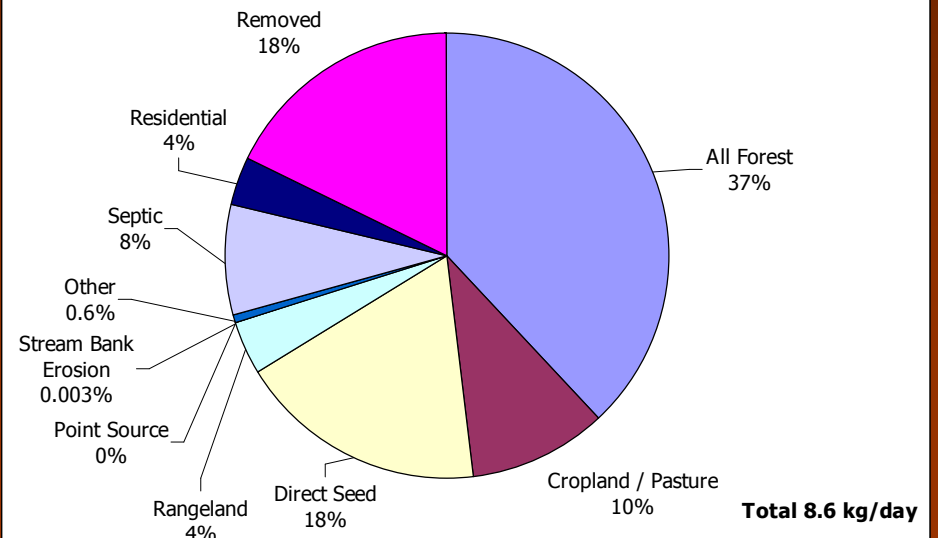
	Reference Condition	Current Condition
All Forest	11.9	10.7
Cropland / Pasture	13.4	35.9
Direct Seed	19.1	0.0
Rangeland	4.9	7.0
Stream Bank Erosion	26.0	29.8
Point Source	0.0	11.2
Other	0.4	0.4
Septic	3.9	5.5
Residential	2.8	2.7
Removed	20.7	

Comparison: Base to Reference

**Current Conditions
Total P at State Line**



**Reference Conditions
Total P at State Line**



1 kg = 2.205 lbs

Hangman Creek at the Idaho Border

	Reference Condition	Current Condition
All Forest	8.8	7.3
Cropland / Pasture	2.3	6.7
Direct Seed	4.2	0.0
Rangeland	0.9	2.6
Stream Bank Erosion	0.0	0.2
Point Source	0.0	3.0
Other	0.1	0.2
Septic	1.9	2.5
Residential	0.8	0.8
Removed	4.1	

Requested Scenarios

- Idaho meets proportional phosphorus load at border
- Cheney as existing condition vs. fully discharging to Minnie Creek
- Graduated land use conversions
- Graduated streambank improvements
- Graduated reforestation
- Graduated direct seed implementation

